Bio-detoxification of spent sulphite liquor to produce second generation bioethanol by Scheffersomyces stipitis

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INTRODUCTION

Hardwood Spent Sulphite Liquors (HSSL) are side products from acidic sulphite wood pulping and, after their concentration by evaporation, are normally burned for energy recovery [1,2]. The great advantage of HSSLs over other lignocellulosic feedstocks is that during wood pulping process, delignification and hydrolysis results in fermentable sugars. The major components of HSSLs are sulphonated lignin (lignosulphonates) and sugars, around 40-45 g L\(^{-1}\), mainly xylose [1, 2]. Xylose can be converted by Scheffersomyces stipitis to second generation bioethanol. However the presence of high amounts of acetic acid and lignosulphonates in HSSLs is inhibitory for microbial growth [2, 3, 4].

The filamentous fungus Paecilomyces variotii is able to grow in HSSLs, consuming most of the inhibitory compounds [4]. This process, designated as biological detoxification step of HSSLs should be performed before the ethanol production step by S. stipitis [2, 4]. The detoxification step was studied using a Sequential Batch Reactor (SBR) with 3 cycles since a higher amount of detoxified liquor was obtained [4]. Hence, the aim of this study was to evaluate bioethanol production by S. stipitis from the sugars present in HSSL before and after the bio-detoxification by P. variotii. The two fermentative strategies were compared in order to select the best one.

METHODOLOGY

Take Home Messages

- P. variotii consumed all the acetic acid present in HSSL.
- A higher amount of bio-detoxified HSSL (0.750 L vs. 0.250 L with single batch) was obtained with this approach.

- P. variotii, consumed also toxic compounds such as, gallic acid, pyrogallol among others.
- The bio-detoxified HSSL was rich in low molecular weigh organic acids, showing that the fungus was able to consume the major toxics in the HSSL.

- P. variotii successfully metabolized several known toxic compounds such as gallic acid and pyrogallol.
- With the bio-detoxified HSSL a higher ethanol concentration and yield were attained (2.4 g L\(^{-1}\) and 0.17 g g\(^{-1}\) respectively).
- The use of P. variotii was an effective approach for the HSSL bio-detoxification, providing a substrate with less toxics for S. stipitis ethanol fermentation.

RESULTS AND DISCUSSION

- With the bio-detoxified HSSL S. stipitis produced 2.4 g L\(^{-1}\) of ethanol with a yield of 0.17 g g\(^{-1}\).
- S. stipitis possesses toxic compounds that inhibit the fermentative metabolism of S. stipitis.

BIBLIOGRAPHY